

FLOOD INSURANCE STUDY



**TOWN OF
GEORGIA,
VERMONT
FRANKLIN COUNTY**



MARCH 16, 1981



**federal emergency management agency
federal insurance administration**

COMMUNITY NUMBER - 500217

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PUBLISHED SEPARATELY:

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY
TOWN OF GEORGIA, VERMONT

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Georgia, Franklin County, Vermont, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Georgia to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by DuBois and King, Inc., for the Federal Insurance Administration, under Contract No. H-4749. This work was completed in March 1980.

1.3 Coordination

On April 6, 1978, the areas to be studied by detailed and approximate methods were determined at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of the FIA, the Town of Georgia, and DuBois and King, Inc. (the study contractor). Federal, state, and private organizations were notified of the study, and a request was made for any available information related to the flood hazard areas in Georgia. Community officials were asked for pertinent information on historic flooding in the town. On October 16, 1980, the results of the study were reviewed at a final CCO meeting held with representatives of the FIA, the town, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Georgia, Franklin County, Vermont. The area of study is shown on the Vicinity Map (Figure 1).

The Lamoille River, including Arrowhead Mountain Lake, and the Lake Champlain shoreline from the Town of Georgia/Town of Milton corporate limits to the Town of Georgia/Town of St. Albans corporate limits were studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through March 1985.

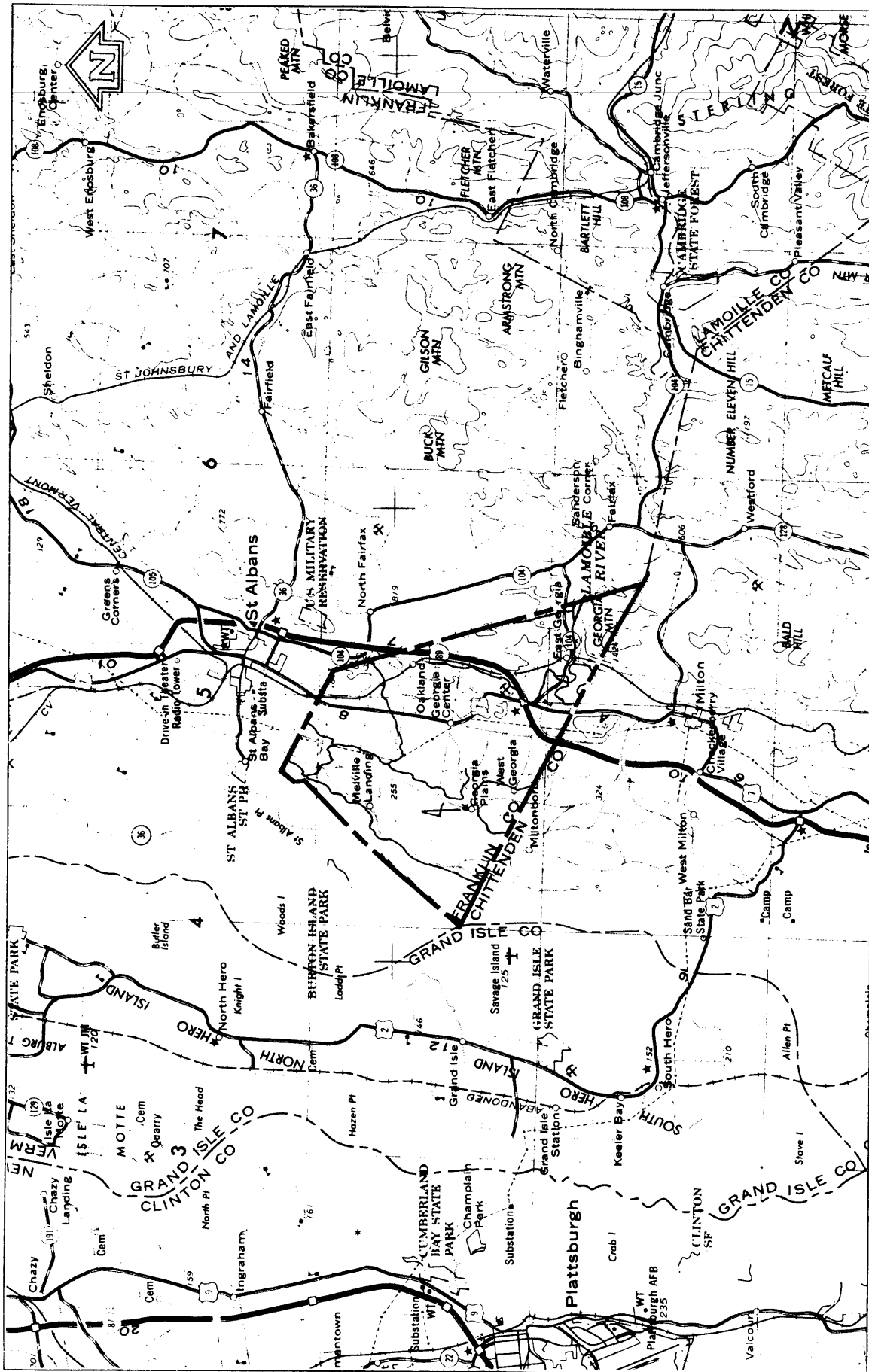
The Rugg River, the Mill River, the upper portion of Stone Bridge Brook, and an unnamed tributary flowing into Arrowhead Mountain Lake were studied by approximate methods. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study.

2.2 Community Description

The Town of Georgia is located in the southwestern corner of Franklin County in northwestern Vermont. It is bordered by the Town of St. Albans to the north, the Town of Fairfax to the east, the Town of Milton to the south, and Lake Champlain to the west. The total land area contained within Georgia's corporate limits is 47.8 square miles (Reference 1).

The population was 1,711 in 1970 and was estimated to have increased to 2,312 in 1977 (References 2 and 1). There is little commercial or residential development expected to occur in Georgia. Presently, the town has scattered development, consisting of single-family residences, a few private businesses, and several farms. The majority of development near the coastal areas along Lake Champlain consists of seasonal dwellings. Development near Arrowhead Mountain Lake and along the Lamoille River consists of a small amount of residential housing, with the majority of the flood plain utilized for woodlands or agricultural purposes.

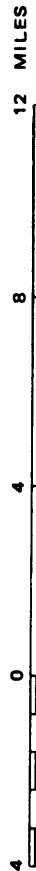
The old lake plains and terraces (for example the area around Arrowhead Mountain Lake) have level to gently sloping areas of excessively drained and moderately, well drained sandy soils. The topography upstream of eastern Georgia is gently sloping to steep, with moderately well drained to well drained loamy soils (Reference 3).



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APPROXIMATE SCALE



VICINITY MAP

FIGURE 1

The climate of Georgia is characterized by temperatures that range from below -4 degrees Fahrenheit (°F) to maximum summer temperatures near 86°F. The average annual precipitation over the area is 34 inches (Reference 4). The annual snowfall in Georgia averages 80 inches (Reference 5).

2.3 Principal Flood Problems

Low-lying areas in Georgia are subject to periodic flooding caused by the overflow of the Lamoille River and its tributaries. Also, fluctuations in the water level of Lake Champlain produce flooding along the shoreline. The most frequent flooding occurs in early spring as a result of snowmelt and heavy rains, but historical data indicate flooding has occurred in every season.

The flood of 1927 is the flood of record on the Lamoille river and has an estimated recurrence interval of more than 500 years. Other major floods on the Lamoille River occurred in 1936, 1938, 1940, 1942, 1973, 1976, and 1977. The discharges for these floods were 23,200 cubic feet per second (cfs), 20,200 cfs, 22,300 cfs, 19,400 cfs, 18,000 cfs, 17,400 cfs, and 16,300 cfs; the estimate recurrence intervals were 22 years, 12 years, 15 years, 10 years, 8 years, 7 years, and 6 years, respectively. The recurrence intervals are based on the frequency curve developed from the gage records of the U. S. Geological Survey (USGS) gage located on the Lamoille River at East Georgia, Vermont.

Lake Champlain high-water levels occurred in 1939 (11-year), 1947 (10-year), 1971 (15-year), 1972 (23-year), and 1976 (28-year). The recurrence intervals are based on the frequency curve developed from the gage records of the USGS gage located on the lake at Rouses Point, New York.

Figures 2 and 3 show potential flood heights at two locations within the Town of Georgia.

2.4 Flood Protection Measures

There are no flood protection measures present or planned in the Town of Georgia. The town does discourage construction in the flood plain, which is enforced through its zoning regulations (Reference 6).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or

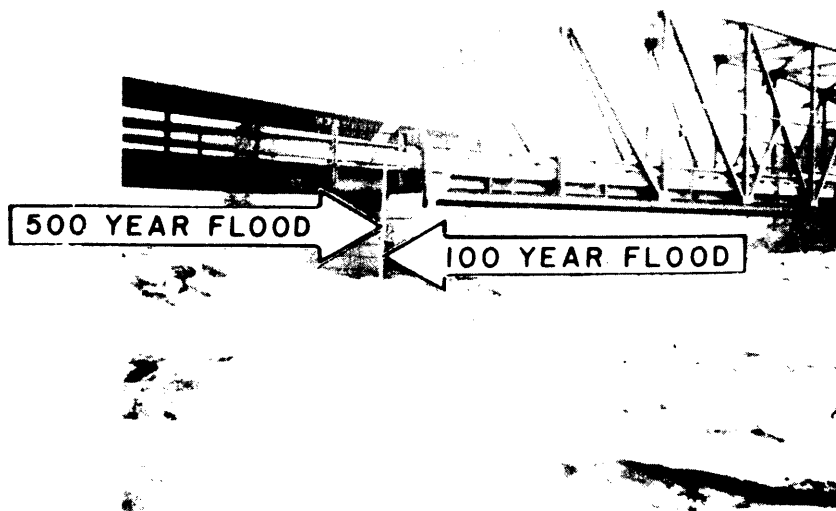


Figure 2 - Potential flood heights at Town Highway 1 (East Georgia Highway Bridge) in the Town of Georgia.



Figure 3 - Potential flood heights at State Route 104-A in the Town of Georgia.

500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The flood flow discharges for the Lamoille River were determined by a log-Pearson Type III analysis as outlined by the Water Resources Council (Reference 7). The two USGS gages used in this study on the Lamoille River are at the Towns of Johnson and East Georgia. The gage (No. 04292000) at Johnson has a period of record of 51 years, from 1912 to 1913 and from 1929 to 1977. The gage (No. 04292500) in East Georgia has a period of record of 48 years, from 1930 to 1977 (Reference 8).

A summary of drainage area-peak discharge relationships for the Lamoille River is shown in Table 1, "Summary of Discharges".

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u> <u>(sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
LAMOILLE RIVER					
At the USGS gage in East Georgia	686	19,100	28,300	33,310	48,330

Stage-frequency relationships used for Lake Champlain were determined in the Flood Insurance Study for the City of Plattsburgh, New York, by

graphical frequency analysis of data measure at the Rouses Point, New York, gage (Reference 9). The gage has been in operation since 1869. The stages determined for the selected recurrence intervals were approved for general use at a meeting in Burlington, Vermont, in October 1976, attended by representatives from all Flood Insurance Study contractors and government agencies concerned with flooding along Lake Champlain.

A summary of elevation-frequency relationships for Lake Champlain is shown in Table 2, "Summary of Elevations".

TABLE 2 - SUMMARY OF ELEVATIONS

<u>FLOODING SOURCE AND LOCATION</u>	<u>ELEVATION (feet)</u>			
	<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
LAKE CHAMPLAIN	101.01	101.76	101.97	102.32

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the U. S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 10). Starting water-surface elevations for the Lamoille River were computed by the slope/area method.

Cross-section data were obtained by photogrammetric methods (Reference 11); the below-water data were obtained by field survey. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic computations were determined by using the method outlined by Chow and by engineering judgment (Reference 12). The channel "n" values for the Lamoille River ranged from 0.026 to 0.034, and the overbank "n" values ranged from 0.030 to 0.073.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a

floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

The extent of 100-year flooding on the streams studied by approximate methods was determined by developing flood flows using a method for ungaged streams (Reference 13). Normal depth calculations were made at selected cross sections to determine approximate topwidths.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 11). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using the Flood Hazard Boundary Map for the Town of Georgia (Reference 14).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100- year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this report is presented to local agencies as a minimum standard that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF's), and flood insurance zone designations for each flooding source affecting the Town of Georgia.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Lamoille River	1							
A	6,200	326	4,035	8.3	292.2	292.2	292.2	0.0
B	6,325	310	4,269	7.8	293.2	293.2	293.2	0.0
C	6,545	313	4,022	8.3	294.0	294.0	294.0	0.0
D	8,340	350	2,291	14.5	296.3	296.3	296.3	0.0
E	8,975	385	2,568	13.0	301.3	301.3	301.3	0.0
F	9,220	280	3,215	10.4	303.1	303.1	303.1	0.0
G	10,580	375	3,866	8.6	305.9	305.9	306.0	0.1
H	12,140	320	2,631	12.7	308.8	308.8	309.0	0.2
I	14,480	305	2,848	11.7	319.0	319.0	319.0	0.0

¹Feet above corporate limits

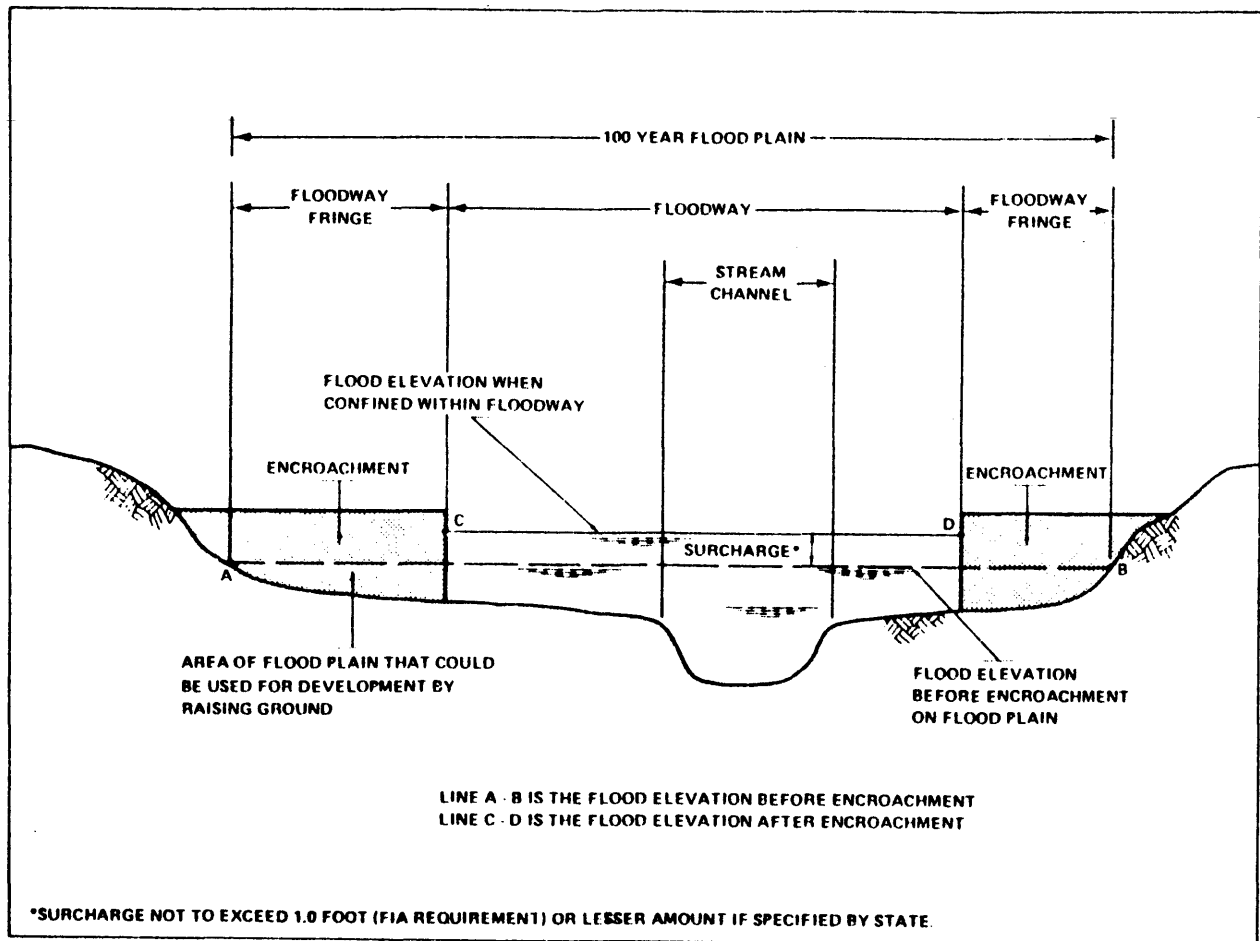
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Federal Insurance Administration

TOWN OF GEORGIA, VT
(FRANKLIN CO.)

FLOODWAY DATA

LAMOILLE RIVER

TABLE 3



FLOODWAY SCHEMATIC

Figure 4

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100-Year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Georgia are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 4).

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ³ ELEVATION (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Lamoille River Reach 1 Reach 2	08 08	-0.5 -2.6	-0.2 -0.8	+0.7 +2.2	005 025	A1 A5	Varies Varies
Lake Champlain Reach 1	01,03,06	-1.0	-0.2	+0.4	010	A2	102

¹Flood Insurance Rate Map Panel

²Weighted Average

³Rounded to the nearest foot - see map

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FLOOD INSURANCE ZONE DATA

LAMOILLE RIVER AND LAKE CHAMPLAIN

TABLE 4

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire incorporated area of the Town of Georgia was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

- | | |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zone A: | Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHF's determined. |
| Zones A1, A2
and A5: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided. |
| Zone C: | Areas of minimal flooding. |

Table 4, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the Town of Georgia.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Georgia is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

In May 1976, the COE published a Flood Plain Information report on the Lamoille River for the Towns of Georgia, Fairfax, and Fletcher (Reference 15). The differences in the water-surface elevations between this study and the COE report are due to an update in the hydrologic analyses. The differences between the reports have been reconciled by both the FIA and COE.

Flood Insurance Studies for the Towns of Milton and Fairfax are currently being prepared (References 16 and 17). The results of those studies will be in exact agreement with the results of this study. The Flood Hazard Boundary Map for the Town of Georgia has been published (Reference 14).

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

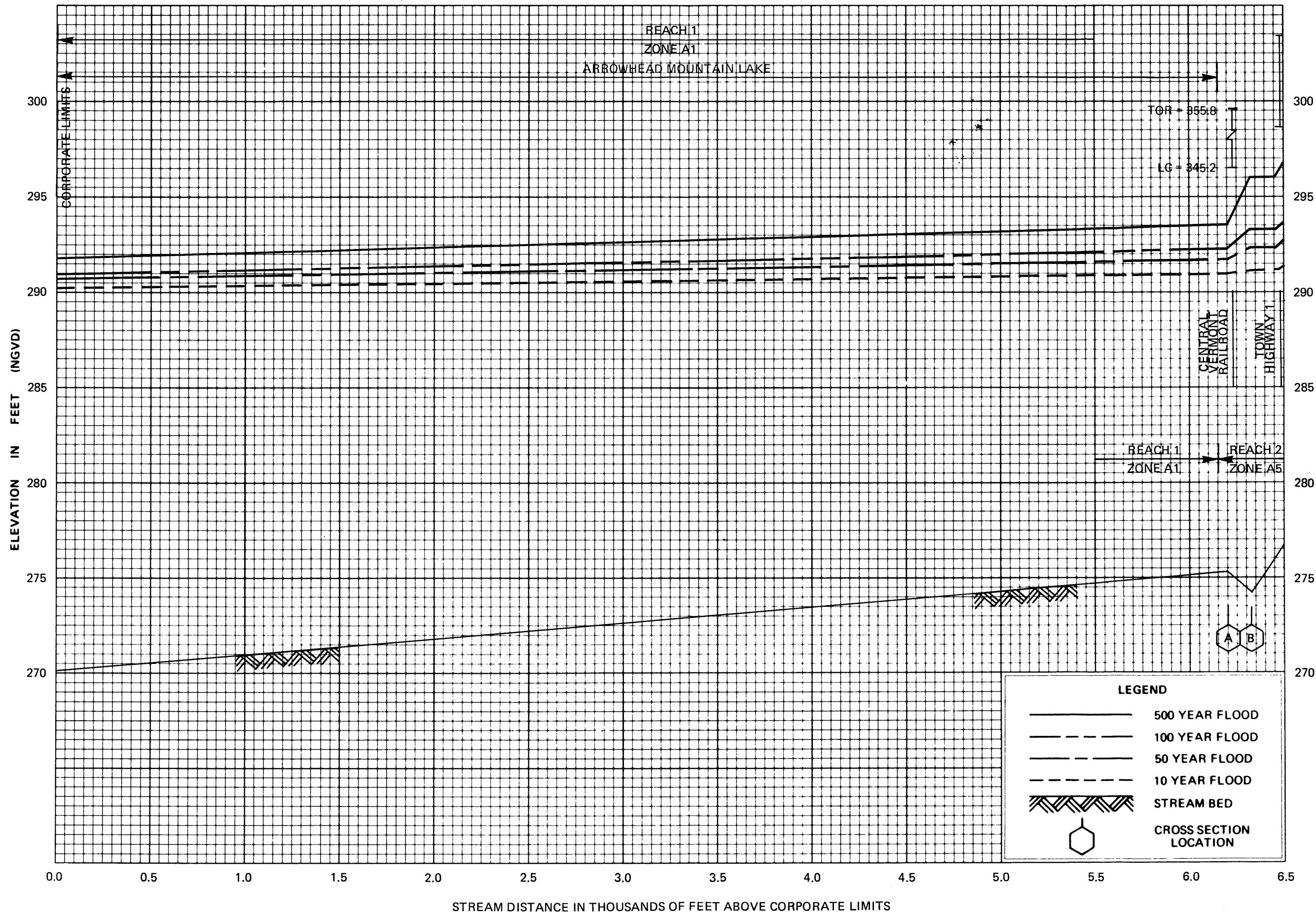
Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region I Office, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

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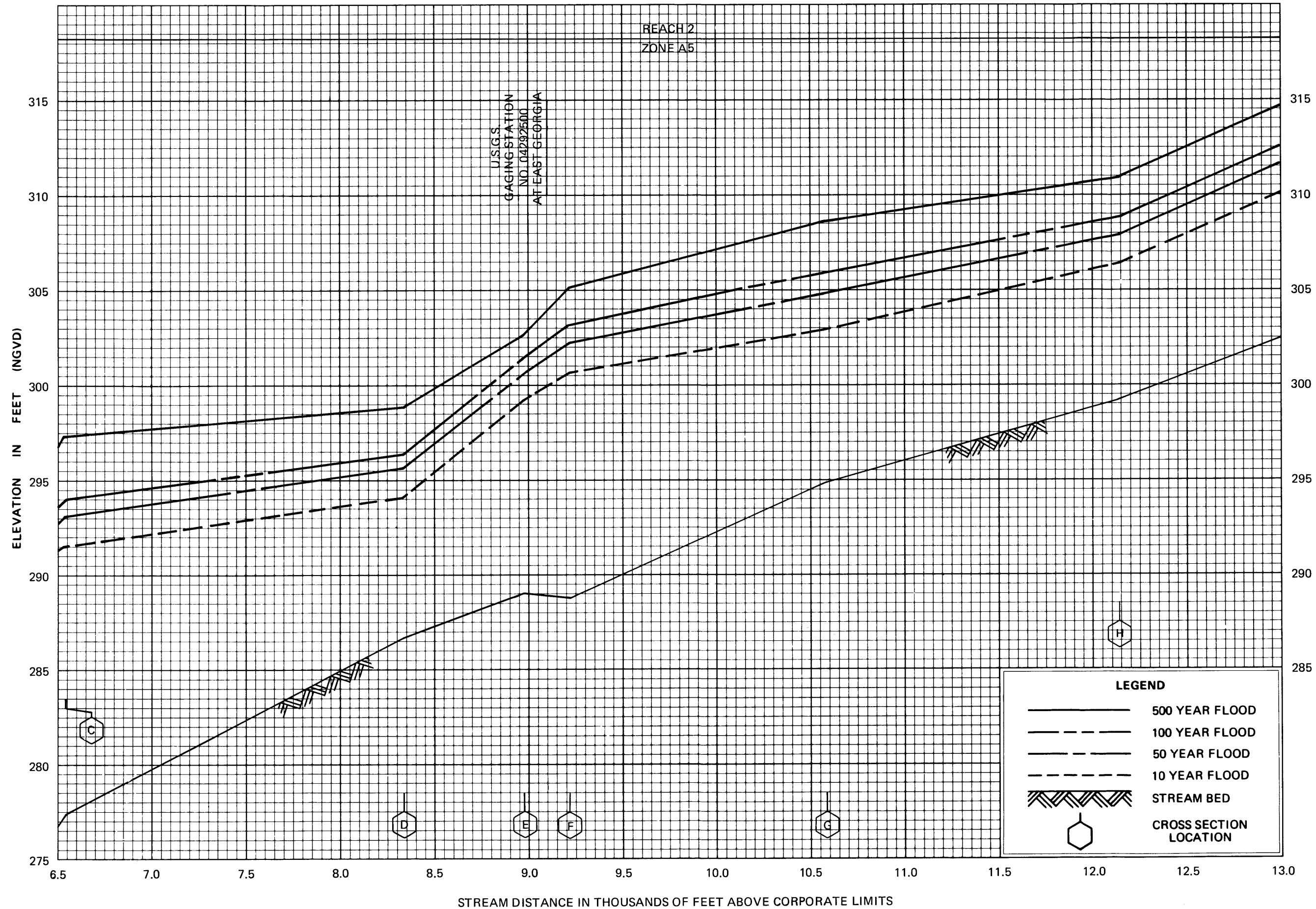


FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF GEORGIA, VT
(FRANKLIN CO.)



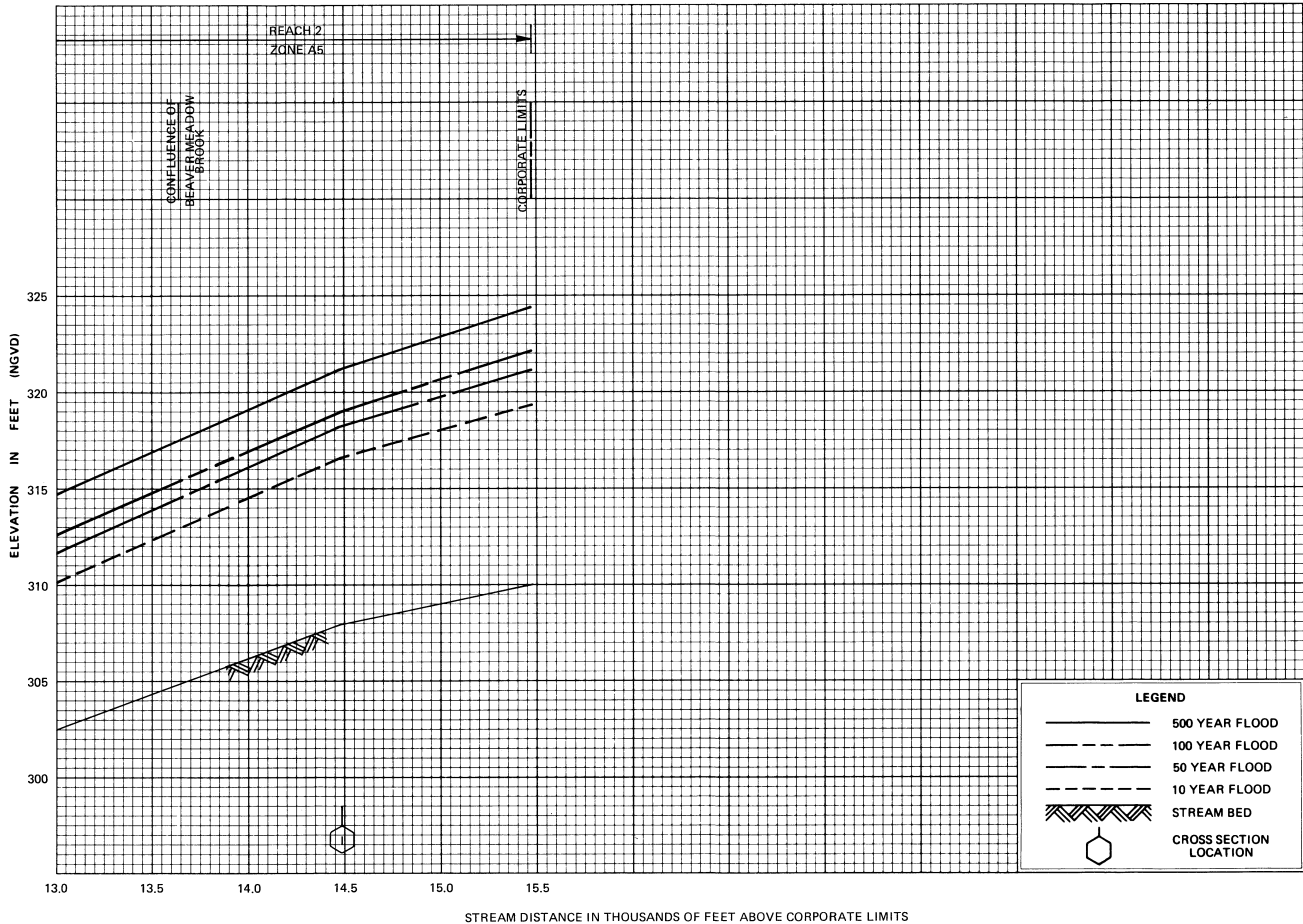
FLOOD PROFILES

LAMOILLE RIVER

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02P



FLOOD PROFILES
LAMOILLE RIVER

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(FRANKLIN CO.)